

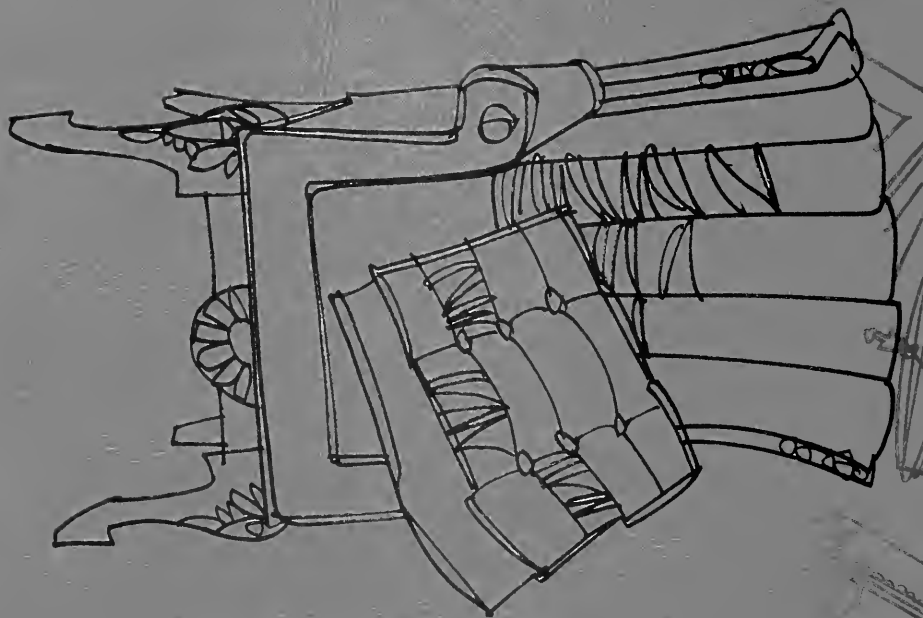
INDIRECT COSTS OF RESIDENTIAL FIRES

FEDERAL EMERGENCY
MANAGEMENT AGENCY

U.S. Fire Administration

FA-6
April 1980





INDIRECT COSTS OF RESIDENTIAL FIRES

Michael J. Munson and James C. Ohls

Prepared by
Princeton University
and
Mathematica Policy Research, Incorporated
For the
Federal Emergency Management Agency
U.S. Fire Administration
National Fire Data Center

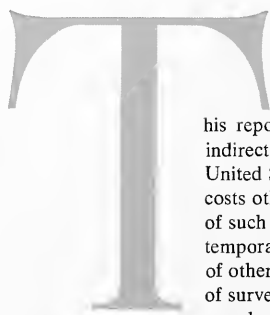
July 1979

We are greatly indebted to Gus Garcia, who, as survey manager for the project, was responsible for all aspects of survey operations from instrument development to overseeing the fielding of the interviews. We also wish to thank Jerilyn Weber, who did an excellent job of obtaining the sample of fires from fire department records and serving as the project manager for the study. In addition, we must thank Pat Lapczynski for handling our computer requests and Julie Cheng for helping to develop the analysis tapes. Finally, we appreciate the work done by the data processing department of Mathematica Policy Research, Inc., under the direction of Jerry Kole.

Many thanks must also go to the fire department personnel who assisted us in completing the study. Without their help and encouragement, the study would not have been feasible. Among the many individuals who helped in this regard are J. I. Gibson and Henry C. Daniel, Atlanta Bureau of Fire Services; George H. Paul and Peter F. Moran, Boston Fire Department; Karl K. Kubiak and Edward C. DeYoung, Buffalo Department of Fire; Dodd Miller, James L. Hatcher, and Michael Freeman, Dallas Fire Department; Merrill Wise and John J. Cawley, Denver Department of Fire; Robert Kipp and Donald B. Stein, Kansas City Fire Department; Kenneth R. Long, David B. McDonald, and Timothy DeLuca, Los Angeles Department of Fire; William Stamm, Robert J. Heindl, and Carl W. Klitzke, Milwaukee Fire Department; Daniel George, Trenton Fire Department; Donald R. Ryan and Mary L. Humphreys, Division of State Fire Marshal, State of Ohio; and Harry Barnett and Bonnie L. Arnold, Office of State Fire Marshal, State of Oregon.

Throughout the study many people took the time to speak with us concerning various aspects of the work. In particular we would like to thank Philip Schaenman, John Ottoson, Paul Gunther, Henry Tovey, and Geraldine Fristrom at the National Fire Data Center for their many thoughtful and useful comments on an earlier draft of this report. They also furnished leads to other researchers who, in turn, provided many useful ideas and information.

	<i>Page</i>
Executive Summary	iv
I Introduction	1
II National Estimates of Indirect Fire Costs	5
A. Definition of Indirect Versus Direct Losses	7
B. Alternative Conceptual Definitions of Indirect Costs	7
C. National Estimates of Indirect Fire Costs of Residential Fires	8
III The Nature of Indirect Losses	11
A. The Components of Indirect Costs of Residential Fires	13
1. The Cost of Obtaining Temporary Shelter	13
2. The Cost of Medical Care for Injuries	14
3. Costs Due to Work Missed	16
4. The Costs of Funeral Services	17
5. Extra Costs for Meals	17
6. Costs of Demolishing a Damaged Structure	17
7. Legal Fees Associated with the Fire and Recovery	18
8. Extra Transportation Costs	18
9. The Costs of Emotional Counseling	18
10. Costs of Temporary Child Care	19
11. Other Indirect Costs	19
12. Nonmonetary Costs	20
13. Summary	20
B. Relationships Between Indirect Costs Caused by Residential Fires and Characteristics of the Households Experiencing the Fires	21
C. Relationships between Indirect Costs Caused by Residential Fires and the Direct Losses Caused by Those Fires	24
IV Techniques for Local Estimation of Indirect Residential Fire Costs	27
1. Use of a Simple Average	28
2. Simple Averages for Classes of Residential Fires	29
3. Simple Averages for Direct Property Loss Categories	30
4. Summary	30

A large, stylized, grey drop cap letter 'T' that serves as a decorative element for the first paragraph of the executive summary.

his report presents national estimates of indirect losses resulting from residential fires in the United States, where indirect losses are defined as costs other than direct property damage. Estimates of such losses, which include medical costs, temporary housing costs, lost wages, and a number of other components, are developed on the basis of survey information from a stratified random sample of 883 households which had experienced fires approximately four months prior to being interviewed.

National Estimates of Indirect Costs

Two loss measures are used in the analysis. The first, total indirect losses, includes all indirect costs to which it was possible to assign a monetary value. Such losses are estimated at between \$220.3 million and \$322.6 million per year, depending on alternative assumptions concerning the total number of residential fires occurring in the United States. The second loss measure, out-of-pocket costs borne directly by households affected by fires, is estimated at between \$105 million and \$153.8 million per year.

All of these cost estimates are subject to considerable statistical sampling error due to the relatively small sample on which they are based. In particular, it is estimated that the sampling error could easily be as much as plus-or-minus 28 percent of the specific loss estimates. In addition, there is some possibility of downward biases in the estimates because of difficulties in locating households which had moved as a result of particularly serious fires and because, particularly in the case of fires involv-



ing serious injuries, some costs may not have been incurred by the time of the survey. While such downward biases are possible, however, attempts to check the survey-based loss estimates against independently derived figures from other sources suggest that the estimates described here are in all likelihood at least of the correct order of magnitude.

The largest individual component of total indirect losses is temporary shelter costs, which account for nearly 45 percent of all such losses. Medical costs represent the second largest component, accounting for approximately 24 percent of the total, while the third largest component, costs due to missed work, represents about 12 percent of such costs. When only out-of-pocket costs are considered, these estimates change considerably. Medical care accounts for approximately 38 percent of all such costs, with the corresponding portions for temporary shelter and missed work amounting to 22 percent and 17 percent, respectively. Other types of indirect fire losses include funeral expenses, the cost of food purchased outside the home, the cost of demolishing ruined buildings, fees paid for emotional counseling, and legal fees.

Important sources of assistance to households in meeting indirect costs included friends and relatives, insurance companies, government agencies, and such private support organizations as the Red Cross. The most common source of assistance to households in meeting temporary shelter costs was friends and relatives, with approximately 66 percent receiving aid from this source. Insurance companies were the primary source of assistance in meeting medical expenses.

Intangible Costs of Residential Fires

In addition to the monetary costs discussed above, fires also result in many serious costs to which monetary values cannot be assigned. The survey data indicate that in 1976 almost 170,000 households experienced fires that caused at least one member of the household to seek temporary shelter. These dislocations were not trivial, averaging more than 27 days in length.

While the costs of medical care were discussed previously, it is important to note that the very existence of injuries imposes intangible costs on the households involved. It is estimated that almost 62,000 households experienced residential fire-related injuries in 1976, and that almost 79,000 household members were injured.¹

Closely related to costs imposed by physical injury are the psychological costs imposed by the fires. The survey data suggest that more than 115,000 persons experience emotional problems each year as a result of residential fires. An estimated 29 percent of these individuals have emotional difficulties which they describe as very serious, while another 39 percent of the problems are at least somewhat serious.

After a serious fire it is often necessary for one or more members of the household to miss work for a time, either because they are recovering from injuries or because they must help arrange the household's recovery. On the basis of the survey data, it is estimated that almost 92,000 households each year experience this kind of disruption because of residential fires.

Finally, it is estimated that more than 100,000 households annually find that fires have destroyed such irreplaceable objects as photographs, family heirlooms, or pets.

Relation of Indirect Costs to Direct Losses

On the average, the indirect losses of higher income households that experience residential fires are greater than those of lower income households. Similarly, the magnitude of indirect losses is higher on the average for whites than for other racial groups and is higher for residents of owner-occupied housing than for apartment dwellers.

There is a significant correlation between direct costs (i.e., property costs) of fires and the indirect costs considered in the present study. However,

there is considerable variance around this direct/indirect cost relationship, and even fires with very low direct costs sometimes cause large indirect losses, particularly fires resulting in injuries.

Fire department estimates of direct losses were found to be quite consistent with estimates provided by the affected households. Fire department estimates appeared to understate losses in 32 percent of the cases while overstating them in 30 percent. There seemed to be no appreciable systematic bias in the estimates prepared by the fire departments, even though there was considerable variation.

Methods for Local Fire Departments to Estimate Indirect Costs

Three alternative approaches for making estimates of indirect fire costs at the local level are described in this report. The simplest of the three methods involves multiplying the total number of residential fires in the local area by an estimated average indirect cost per fire as derived in the present study. The other two methods require classifying local residential fires on the basis of direct losses and on the basis of reported injuries or deaths. For each category, the number of fires is then multiplied by the estimated average loss for the category.

This document presents the "Executive Summary" and first four chapters of *Indirect Costs of Residential Fires: Final Report*. The full report, including an additional chapter on research which could be undertaken to develop improved estimates of indirect costs and the Appendices, will be made available from the National Technical Information Service. Write: NTIS, 5285 Port Royal Rd., Springfield, Va. 20234.

¹ This estimate differs from the USFA estimate of 21,300 injuries which is derived from fire department records. Relatively minor injuries which do not require professional medical treatment or result in restrictive activity of one day or longer do not meet NFPA 901 reporting requirements, and are therefore not likely to be included in fire department data.

I. INTRODUCTION



Ever since the publication of *America Burning*, the report of the National Commission on Fire

Prevention and Control, concern over the magnitude of fire losses in the United States has been growing. One often cited estimate indicates that the "total economic cost of destructive fire in the United States" is \$11 billion each year.² This figure represents an attempt to estimate both the direct property losses caused by fires and the indirect costs such as medical expenses or loss of jobs and income.

Much study has been devoted to the estimation of direct property losses from fires, but the extrapolation from direct property losses to total costs has so far been based as much on conjecture as on systematic research. In order to prepare more accurate estimates of total losses due to fires, it is necessary to improve our knowledge of these indirect costs. To this end, this report presents first-cut, national estimates of the magnitude of the indirect component of total residential fire costs. It thus represents a first step in bridging the gap between readily measured property loss due to fires and the total cost of fires, including indirect costs.

The research presented in this report focuses exclusively on reported residential fires—a category which accounts for approximately two-thirds of all structural fires in the country.³ Direct property losses attributed to residential fires amount to approximately 53 percent of direct property losses from all structural fires.⁴ Thus, residential fires clearly account for a substantial portion of the total fire losses.

The findings presented in this report are based on a survey of 883 households from 10 sites across the country. These households had experienced residential fires within approximately four months of the time of the interviews, and were thus able to provide information on both the direct and indirect losses associated with their fire experiences. On the basis of this information, the total indirect costs of residential fires in the United States are estimated to range from \$220.3 million to \$322.6 million annually. (See Chapter II beginning on page 6.)

These indirect losses are in addition to direct residential property losses estimated elsewhere to be approximately \$1,371 million annually.⁵ While the estimated indirect losses suggest that total losses due to residential fires should be increased by from 16 to 24 percent in estimating total costs, it must also be noted that the indirect cost estimates do not include measures for the grief or anxiety caused by death and injury. Since residential fires account for a very large proportion of fire-related deaths and injuries,⁶ the monetary estimates reported here provide only a partial measure of the indirect costs of these fires.

This report consists of four chapters, including this brief introduction. Chapter II presents a more detailed discussion of the magnitude of the indirect residential fire costs incurred annually in this country. Following the discussion of the overall national estimates, Chapter III presents a detailed discussion of the nature, magnitude, and distribution of these indirect costs based on data from the survey. The report examines various components of these costs and discusses their distribution among different types of households. Chapter III also includes a brief discussion of the magnitude of indirect costs associated with different categories of fires.

On the basis of these findings, Chapter IV proposes methods by which local fire departments can prepare estimates of the indirect costs caused by reported residential fires in their own service areas.



² Federal Fire Prevention and Control Act of 1974, Public Law 93-498, Sec. 2(a).

³ Only fires reported to local fire departments are considered here. The National Household Fire Survey indicates that only a small proportion (perhaps 1/10) of residential fires are reported, but resource constraints precluded searching for unreported fires. It should also be noted that hotel and motel fires were not considered in this study.

⁴ Derry, Louis, *Fire Journal*, November 1977.

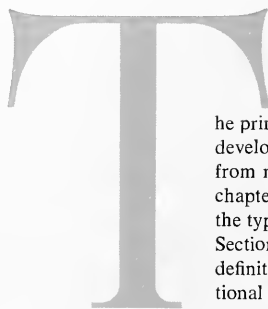
⁵ Louis Derry presents these estimates for 1976 in the November 1977 issue of *Fire Journal*. These direct property losses were caused by an estimated 665,384 fires in residential structures (excluding hotels and motels). It should be noted that the \$11 billion cost estimate cited earlier includes the value of work missed due to industrial and commercial fires, indirect losses which, over a 1- to 2-year rebuilding period, can be extremely large. This is at least a partial explanation of the difference between Derry's estimates and the \$11 billion figure cited earlier.

⁶ Clarke, Dr. Frederic B. and Ottoson, John, "Fire Death Scenarios and Their Role in Firesafety Planning," *Fire Journal*, May 1976. The authors report that residential fires account for from 76 to 84 percent of fire deaths. While data could not be located concerning injuries, injury patterns may be similar.



II. NATIONAL ESTIMATES OF INDIRECT FIRE COSTS



A large, stylized, light gray capital letter 'T' that serves as a decorative element, spanning the width of the first paragraph.

The principal aim of the research was to develop estimates of annual indirect costs resulting from residential fires in the United States. This chapter presents these estimates. Section A describes the types of fire costs covered in the research; Section B presents several different conceptual definitions of indirect costs which were used; national aggregate cost estimates are then presented in Section C, together with a brief description of the methodology used for calculating them.

Several caveats must be kept in mind when considering the figures discussed in this report. The estimated costs may include some downward bias due to the possibility that it may be particularly difficult to obtain interviews with members of households which experience the most serious fires. While extensive procedures were incorporated into the data collection process to minimize the extent of this problem, it is unlikely that all bias resulting from this situation has been eliminated. In addition, it should be noted that the interviews were conducted approximately four months after the fires experienced by the households and it is therefore possible that not all costs had been incurred, particularly in the case of households with members requiring extensive medical treatment. This too could result in an understatement of total costs. Still another possible reason for inaccuracy in the estimates is that, in the cases where costs were covered by insurance, households may not have been fully aware of the actual costs incurred.

For all these reasons, it is possible that the figures reported here may somewhat underestimate actual indirect costs associated with residential fires, and this potential for understatement may be greatest with regard to medical costs.

A. Definition of Indirect Versus Direct Losses

The objective of this study was to develop a national estimate of indirect residential fire costs which, when combined with an estimate of direct losses based on fire department fire reports, would yield an accurate overall picture of total losses as the result of reported residential fires in the United States. Since fire department reports typically include in their dollar loss estimates only damage directly done to buildings and contents, the subject of the present study, indirect fire costs, was operationally defined to include all costs other than the value of damage directly done to structures and their contents. In particular, the following categories of indirect costs were considered: medical costs, temporary shelter costs, costs of missed work, extra meal costs, funeral costs, demolition costs, cost of legal fees, and other similar, miscellaneous cost items which are not included in those explicit categories.

Three categories of indirect fire costs which had to be omitted from the cost calculations presented in this chapter should be noted. First, and perhaps most important, no attempt has been made to place a monetary value on the pain, both physical and psychological, experienced by fire victims and their friends and relatives as a result of the fires. Fires often have devastating nonmonetary impacts because of such factors as deaths, injuries, dislocation, loss of cherished and irreplaceable possessions, and trauma. Indeed, in many cases such costs may be greater in magnitude than those to which monetary values can be assigned. Some effort was made in the present study to assess the overall dimensions of these nonmonetary costs, and the results of this work are presented in Chapter III, which begins on page 12. However, such costs are not included in the

monetary loss estimates presented in this chapter simply because it is not possible to assign monetary values to them.⁷

A second indirect cost which was not included in the scope of the current research is medical and related costs for firefighters injured while fighting residential fires. Such costs were not included in the present study because they cannot be estimated on the basis of information obtained from interviews of households experiencing fires.⁸

Finally, a third cost which is not included in this analysis is demolition costs for multi-family dwelling units which had to be torn down as a result of a fire. This cost item, like that of firefighter medical costs, was excluded from the research because it could not be obtained from the household interviews which form the basis of the present study.

B. Alternative Conceptual Definitions of Indirect Costs

Two different ways of conceptualizing indirect costs have been used in the analysis. One of these includes total aggregate costs to society regardless of who bears those costs. This definition of costs (designated as total costs) is important in applications where the objective is to gain as complete a picture as possible of the total costs of fires. For instance, it is this first definition which is appropriate for a cost-benefit analysis of the economic efficiency of further government investment in the development of fire prevention and control technologies.

The second definition of indirect costs that is used here includes only those that are borne by the households experiencing the fires. Under this second definition, losses covered by insurance or borne by public agencies are not included. Similarly, the value of lost worktime for which employers continued to pay wages and the value of temporary shelter

⁷ In many cases, these nonmonetary costs lead fire victims to incur monetary costs by obtaining professional help, and when this happens the resulting monetary costs are included in the cost estimates presented here.

⁸ There have been other studies of firefighter injuries and fatalities. See, for instance, *Fire Fighter Mortality Report*, prepared for the Center for Fire Research, Institute for Applied Technology, National Bureau of Standards, by the International Association of Fire Fighters.

provided by friends or relatives are excluded. This second conceptualization of costs (designated as out-of-pocket costs) is important in contexts where the aim is to measure, at a more personal level, the unexpected burden which fires impose on the families to whom they occur. An example of such a context, for instance, would be policy decisions regarding public assistance programs designed to help such families cope with these costs.

Since both of the above definitions of indirect costs are of potential importance to policymakers, estimates of each of them have been developed in the current research and are discussed in Section C of this Chapter.

C. National Estimates of Indirect Fire Costs of Residential Fires

The interviews on which the current research is based were obtained from a stratified random sample of 883 households which had experienced fires approximately four months prior to their being interviewed. This sample was divided into three groups in order to maximize the efficiency of the resulting cost estimates. In deriving national indirect fire cost estimates, therefore, the first step was to compute the average indirect cost per fire in the sample for each stratum. Next, total fire costs per stratum were estimated by multiplying these average costs for each stratum by independently supplied estimates of the total number of residential fires in each stratum occurring in the United States in 1976.⁹ This was done for the three strata for each of four

estimates of the number of reported residential fires occurring nationally in 1976.¹⁰ The final step was to add the totals for each of the three strata in each of the four estimates to obtain four national estimates of the amount of indirect costs caused by reported residential fires annually in the United States.

TABLE II.1
National Estimates of Indirect Costs for Residential Fires for Different Assumptions Concerning the Number of Fires

Cost in \$ millions		
Estimated Number of Residential Fires	Estimated Total Costs	Estimated Out-of-Pocket Costs
Low estimate of total residential fires in country 502,000	\$220.3	\$105.0
First middle-range estimate of total residential fires in country 665,400	292.1	139.2
Second middle-range estimate of total residential fires in country 700,000	307.3	146.4
High estimate of total residential fires in country 735,000	322.6	153.8

⁹The survey data used in estimating average dollar losses were gathered in the first half of 1977. Hence, the estimates which have been developed should be considered as estimates for 1976 stated in early 1977 dollars.

¹⁰The four estimates were derived as follows. The low estimate is based on incidence rates for the States of Ohio and California combined, obtained from the National Fire Data Center data files. These incidence rates were applied to 1976 Census estimates of the United States population. This generated estimates of 25,800 fires causing injury or death (stratum I); 88,400 fires causing no injury or death, but causing property damage in excess of \$1,000 (stratum II); and 387,800 fires not causing injury or death, and causing property damage of \$1,000 or less (stratum III); a total of 502,000. The second estimate used in the analysis, 665,400 was obtained from the most current figures from the NFPA (excluding hotel and motel fires) as presented in Derry (1977). These were allocated among the three strata according to the proportions derived in the first estimate. The high estimate, 735,000 fires, was obtained from recent studies by the National Fire Data Center that indicate that a total of 2,600,000 fires occur annually, and that 28.3 percent of these are residential (memorandum from Paul Gunther, December 22, 1977). Again, the number of residential fires was allocated among the three strata according to the proportions derived in the first estimate. Finally, a compromise figure of 700,000 residential fires was selected between the last two. These were also allocated among the three strata according to the proportions used in the other estimates. Thus, there is a series of four estimates, ranging from 502,000 to 735,000 residential fires per year.

These calculations were performed for each of the two indirect cost definitions discussed previously in Section B, and the results are presented in Table II.1. As shown in the table, the total annual indirect costs associated with residential fires in the United States range from a low estimate of \$220.3 million to a high of \$322.6 million, depending on the estimated number of residential fires. However, a substantial share of these total costs was borne by persons or organizations other than the households experiencing the fire. Indeed, over half of these costs were distributed outside the households, and the out-of-pocket costs to the households ranged from \$105.0 million to \$153.8 million.

Table II.2 also presents cost estimates by type of cost. It is clear that the most important component

of indirect costs is temporary shelter, which amounts to almost 45 percent of the total. In addition, it is apparent that the top three components listed in Table II.2 (temporary shelter costs, medical care costs, and costs due to missed work) constitute over three-fourths of the total estimated indirect costs and of estimated out-of-pocket costs. This suggests that public policy aimed at alleviating residential fire costs might most appropriately focus on these three components.

In assessing the loss estimates presented here, attention should be given to possible errors in the estimates due to sampling variation. Standard errors of the loss estimates due to sampling have been estimated on the basis of sample characteristics, and the results of these calculations are shown in

TABLE II.2
Summary Of National Indirect Cost Estimates
(In \$ millions)

Cost Component	502,000 Fires		665,400 Fires		700,000 Fires		735,000 Fires		Percent	
	Total Cost	Out-of-Pocket Cost	Total Cost	Out-of-Pocket Cost	Total Cost	Out-of-Pocket Cost	Total Cost	Out-of-Pocket Cost	Total Cost	Out-of-Pocket Cost
Temporary Shelter	\$98.7	\$22.6	\$130.8	\$29.9	\$137.7	\$31.5	\$144.5	\$33.1	44.8%	21.5%
Medical Care ¹	53.7	39.7	71.3	52.6	75.0	55.3	78.7	58.1	24.4	37.8
Missed Work	26.2	17.8	34.8	23.5	36.5	24.7	38.4	26.0	11.9	16.9
Funeral	8.1	2.6	10.8	3.5	11.4	3.7	11.9	3.8	3.7	2.5
Extra Food	9.7	6.6	12.9	8.8	13.5	9.2	14.2	9.7	4.4	6.3
Emotional Counseling	4.6	0.8	6.1	1.1	6.5	1.2	6.8	1.2	2.1	0.8
Demolition	4.0	2.4	5.3	3.2	5.5	3.4	5.8	3.5	1.8	2.3
Legal Fees	2.9	2.0	3.8	2.7	4.0	2.8	4.2	2.9	1.3	1.9
Transportation	1.8	1.5	2.3	1.9	2.5	2.0	2.6	2.2	0.8	1.4
Child Care	0.7	0.4	0.9	0.6	0.9	0.6	1.0	0.7	0.3	0.4
Other	9.9	8.6	13.1	11.4	13.8	12.0	14.5	12.6	4.5	8.2
TOTALS	\$220.3	\$105.0	\$292.1	\$139.2	\$307.3	\$146.4	\$322.6	\$153.8	100.0%	100.0%

¹ It is possible that medical care costs may be somewhat understated.

Table II.3.¹¹ As indicated in this table, for instance, the standard error associated with the \$322.6 million estimate of total indirect costs is approximately \$40 million. This implies that one can be 95 percent certain that—at least with regard to sampling error—the true value of such costs is plus-or-minus \$90.4 million, or approximately 28 percent of the estimated values shown in the table.¹² Similar statements can be made with regard to the estimates for losses borne by households.

The relatively high standard errors shown in Table II.3 imply that the loss estimates developed in the present study must be used with some caution.

While they are suggestive of the overall order of magnitude of indirect fire losses due to residential fires in the United States, they may well be subject to considerable error. This relatively large potential error reflects the present study's being developed only as a rough, first-cut attempt to measure indirect fire losses. The relatively limited resources allowed less than 900 interviews, a relatively small sample for a national study. Furthermore, the precision of the estimates was further reduced by the need to cluster the sample in 10 different sites throughout the country.

TABLE II.3

Standard Errors of Estimates

Base Number of Residential Fires	Standard Error of Total Cost Estimate (\$ millions)	Standard Error of Out-of-Pocket Cost Estimate (\$ millions)
502,000	\$27	\$12
665,400	36	16
700,000	38	17
735,000	40	18

For those who are technically oriented:

¹¹ It should be noted that the standard error estimates were adjusted to partially exclude the effects on them of an observation which appears to be an extreme outlier in the sample.

¹² The standard error estimates in Table II.2 have been estimated with nine degrees of freedom. Therefore, a 95 percent confidence interval extends approximately 2.26 standard deviations from the estimated loss value.

III. THE NATURE OF INDIRECT LOSSES



In the previous Chapter, two conceptual definitions of indirect monetary costs were developed and several components of these indirect costs in descriptions of national estimates of indirect costs were identified. This Chapter discusses these components in detail. To the extent possible, nonmonetary costs are also discussed. Finally, this Chapter examines characteristics of the fire-victim households and relationships between the indirect costs and the direct losses caused by the fires.

The findings reported in this Chapter are based on data obtained from the survey conducted for the present research. Like the national estimates reported in Chapter II, these data were weighted to reflect differences in the number of fires in each of the three sampling strata included in the sample design, in order to obtain proper national figures.

TABLE III.1

Summary of Indirect Costs in Each Component

Component of Indirect Fire Costs	Percent of Residential Fires Causing Each Component ¹	Average Total Cost Per Fire ¹	Average Out-of-Pocket Cost Per Fire ²
Temporary Shelter	24.1%	\$196.52	\$44.94
Medical Care	8.8	107.14	78.99
Missed Work	13.1	52.09	35.41
Funeral	1.0	16.06	5.17
Extra Food	11.4	19.53	13.21
Demolition	0.9	7.78	4.86
Legal Expenses	1.3	5.79	4.02
Transportation	3.6	3.75	2.87
Emotional			
Counseling	11.2	9.17	1.68
Child Care	1.7	1.31	0.97
Other	4.4	19.80	17.07
All Components	29.4%	\$438.94	\$209.19

¹ Based on total cost definition; 29.4 percent of all residential fires had at least one of these components.

² Weighted average over all fires, including those not involving indirect losses.

A. The Components of Indirect Costs of Residential Fires

In the following pages, 11 specific components of indirect costs, both out-of-pocket costs to the households and total costs, are considered. The sources of assistance received by the households in each of these cost components also are discussed, as well as some of the intangible aspects of these costs. The general findings are summarized in Tables III.1 and III.2.

1. The Cost of Obtaining Temporary Shelter

It is estimated that approximately one-fourth of all reported residential fires in 1976 resulted in at least one member of the household being forced to find temporary shelter. Thus, almost 170,000 households suffered this type of disruption because of a fire in their homes.¹³ In many cases, these were lengthy dislocations. The average for all households dislocated was slightly over 27 days.

¹³ As indicated in Chapter II, these estimates depend on the estimated number of residential fires occurring annually. While a range of such estimates was used in the study, figures cited in this chapter will be based on the compromise estimate of 700,000 reported residential fires. The interested reader can prepare estimates based on other national totals using linear extrapolation methods.

TABLE III.2

Percent Distribution of Assistance Sources for Various Cost Components¹

Component of Indirect Costs	Source of Assistance						Total
	Insurance	Government Agency	Nongovernment Agency	Friends or Relatives	Other Sources	None	
Temporary Shelter	17.0%	0.2%	6.4% (Red Cross)	66.0%	1.9%	8.5%	100.0%
Medical Care	42.1	10.2	1.1	0.0	3.4	43.2	100.0
Missed Work	0.0 ²	not asked	0.0 ² (union)	not asked	0.0	99.9	100.0
Funeral Expenses	10.0	40.0	0.0	10.0	10.0	30.0	100.0
Extra Food	22.0	0.8	3.4	1.7	0.0	72.1	100.0
Demolition	11.1	0.0	0.0	0.0	0.0	88.9	100.0
Legal Expenses	15.4	7.7	0.0	0.0	0.0	76.9	100.0
Transportation	7.9	0.0	0.0	0.0	2.6	89.5	100.0
Emotional Counseling	6.0	3.4	0.0	0.0	0.0	90.6	100.0
Child Care	5.6	0.0	0.0	0.0	0.0	94.4	100.0
Other	23.4	0.0	0.0	0.0	4.3	72.3	100.0

¹ Entries in table indicate estimated percentages of households having types of costs shown in row headings which received assistance from sources in column headings.

² Less than 0.05 percent.

Temporary shelter was defined as shelter used prior to either returning to the original dwelling or moving into new permanent housing. The cost of this shelter included two subcomponents, the cost of finding the shelter, and the cost of the shelter itself. The first subcomponent included such things as fees paid to real estate agents and the cost of traveling to look at potential housing. This search cost was relatively minor, but was included in the total cost of temporary shelter.

The major portion was the cost of the shelter itself. Respondents were asked to indicate the total costs incurred for temporary shelter, as well as the amount of assistance received from any outside sources. It was found, however, that many of the households interviewed had found temporary housing in the homes of friends or relatives, at no cost to themselves. In these cases, it was necessary to estimate the value of these "services in kind" in order to calculate the total social costs associated with the dislocation resulting from the fires. These estimates were based on the average daily costs reported by households which were displaced but which did not receive assistance from these outside sources.

TABLE III.3

Distribution of Total Costs and Out-of-Pocket Costs of Temporary Shelter for Households Which Were Displaced

Shelter Costs (\$)	Percent of Fires Causing Such Total Costs	Percent of Fires Causing Such Out-of-Pocket Costs
0	0%	45.6%
0 to 200	43.4	35.2
201 to 400	10.0	6.4
401 to 750	13.1	5.4
751 to 1,000	5.2	2.8
1,001+	28.3	4.6
Total	100.0%	100.0%

TABLE III.4

Percent Distribution of Fire Injuries by Type

Type of Injury	Percent of All Injuries
Smoke Inhalation	42.4%
Burn	24.3
Shock	12.2
Cut	4.5
Sprain	1.3
Fracture	0.5
Other	14.8
Total	100.0%

As indicated in Table III.1, the average total cost of temporary shelter was approximately \$197 per fire. Not all of these costs, however, fell directly on the households affected; 90 percent of the households with indirect costs received some assistance in meeting them. In addition to services in kind, many of the households reported that some or all of their shelter costs were borne by insurance companies, presumably as part of the settlement on their comprehensive homeowners' policies. When the amount of this assistance was deducted from the total reported cost, it was possible to compute the average temporary shelter cost actually borne by the affected households. As indicated in Table III.1, these out-of-pocket shelter costs averaged approximately \$45 per residential fire. It should be noted that only 25 percent of all residential fires caused temporary shelter costs. Thus, the average total cost for the fires in which such costs were involved was \$815, and the average out-of-pocket cost was \$186. Table III.3 shows the relative frequency of shelter costs of various magnitudes.

2. The Cost of Medical Care for Injuries

Approximately 10 percent of the fires in the survey were selected on the basis of injuries or fatalities having been reported. In fact, approximately 14 percent of the respondents to the survey

indicated that someone in their households had received an injury because of the fire, a finding which suggests that substantial numbers of residential fire injuries are not reported on fire department forms. After weighting the observation to achieve national estimates, it was estimated that approximately 9 percent of all reported residential fires cause injury.

In most cases where a residential fire caused injury, it involved only one individual. There were, however, a sufficient number of multiple-victim fires to cause the average number of victims per injury-fire to reach approximately 1.28. Thus, it was estimated that 61,600 households in the United States experienced residential fires which caused injury to a household member, and that these fires resulted in 78,850 injured people.¹⁴

Residential fires can obviously cause a variety of injuries, and a single victim can suffer more than one injury. It is estimated that the 78,850 victims suffered 97,800 separate injuries. Table III.4 summarizes the distribution of these injuries by type. As might be expected, smoke inhalation and burns are the most frequently suffered civilian fire-related injuries.

The victims received treatment at a variety of locations, and a single victim may have been treated at several places. This latter situation was particularly true for serious burn victims who may have been initially taken to an emergency room and then transferred to a specialized burn center. Estimates of the distribution of treatment locations, based on the survey data, are presented in Table III.5. Clearly, emergency rooms and doctors' offices are the most frequently visited treatment locations. The "other" category includes victims treated on the scene. On an annual basis, residential fires send more than 30,000 victims to emergency rooms for treatment, and almost 1,400 victims to specialized burn centers.

As indicated in Table III.1, the average cost per residential fire for medical care was approximately \$107. However, only 8.8 percent of all residential fires caused such costs, and the average cost for fires causing them was over \$1,200. Thus, it is clear that medical care costs were a major item to the households which incurred them. Table III.2 indicates, however, that more than 55 percent of such households received assistance in meeting these costs from some outside source, primarily insurance companies. When the amount of this assistance is taken into account, the average out-of-pocket costs for medical care averages just under \$80 per fire, or \$900 per fire which results in medical care costs. Table III.6 presents a frequency distribution of medical care costs and indicates that these average values are influenced by a relatively small portion of cases causing extremely high medical care costs. It was estimated that as many as 3,500 fires resulted in total medical care costs of more than \$1,000, while 1,400 fires caused out-of-pocket costs in excess of \$1,000.¹⁵

TABLE III.5

Percent Distribution of Treatment Locations

Treatment Location	Percent of All Injuries
Emergency Room	38.3%
Doctor's Office	17.7
Hospital (Out-patient)	12.1
Hospital (In-patient)	9.2
Clinic	2.5
Burn Center	1.8
Other	18.4
Total	100.0%

¹⁴ This estimate differs from the USFA estimate of 21,300 injuries which is derived from fire department records. Relatively minor injuries which do not require professional medical treatment or result in restrictive activity of one day or longer do not meet NFPA 901 reporting requirements, and are therefore not likely to be included in fire department data.

¹⁵ Since medical costs are often paid by outside sources without the household knowing their exact amount, and since costs of long-term care may not have fully accrued by the time of the interview, these costs may be understated. It should also be remembered that this report deals with medical costs for injuries sustained in reported residential fires. Many serious burns resulting from clothing fires which were not reported to the fire department are therefore excluded from the analysis.

3. Costs Due to Work Missed

Household members may find it necessary to miss work for a time, either because they are recovering from injuries sustained in the fire, or because their help is needed in overseeing repairs, in performing tasks normally done by others who were injured, or in doing other tasks aimed at helping the household recover from the fire experience. It is estimated that almost 92,000 households experienced this type of disruption due to residential fires.

When a person is absent from work, society experiences a cost in terms of production lost. The value of this cost is reflected in the workdays missed by members of the households, and the amount of wages lost because of these absences. In some cases, however, employers may allow the fire victims to take time off from work in the form of medical leave, personal leave, or emergency leave, and not deduct wages for the absence. In such cases, the cost of the absence is actually being borne by the employer. The true *total* cost of indirect losses due to work missed must therefore include both the

TABLE III.6

Distribution of Total Costs and Out-of-Pocket Costs of Medical Care for Households Reporting Injuries

Amount of Medical Care Costs (\$)	Percent of Fires Causing Such Total Costs	Percent of Fires Causing Such Out-of-Pocket Costs
0	4.0% ¹	7.3%
1 to 200	94.3	92.0
201 to 400	0.7	0.4
401 to 750	0.4	0.1
751 to 1,000	0.1	0.1
1,001 +	0.5	0.2
Total	100.0%	100.0%

¹ Persons reporting very minor injuries with no treatment cost, or who were treated at the scene of the fire (cost included in the cost of providing emergency services).

TABLE III.7

Distribution of Total Social Costs and Household Costs of Work Missed Due to Residential Fires for Households Reporting Missed Work

Amount of Costs Due to Missed Work (\$)	Percent of Fires Causing Such Total Costs	Percent of Fires Causing Such Out-of-Pocket Costs
0	0.0%	30.6%
1 to 100	40.0	27.3
101 to 250	25.5	19.8
251 to 500	18.3	12.5
501 to 800	7.4	4.7
801 +	8.8	5.1
Total	100.0%	100.0%

lost wages reported by the respondents and the losses borne by the employer.

To ensure that both costs borne by households and costs borne by employers were included in the calculations, an estimate was made of the total wage loss which would have occurred if wages had actually been deducted. This estimate was based on the reported number of days missed, and the reported wage rate. This estimated figure was compared with the reported wage loss, and the larger of the two was accepted as the measure of the social cost of the work missed.¹⁶ As indicated in Table III.1, residential fires generated average total missed work costs of \$52, and out-of-pocket costs of \$35. Table III.7 presents a percentage distribution of these costs.

For lost-wage costs not borne by employers, respondents were asked if they received outside compensation, but this proved to be a very rare occurrence. While the average figures above seem small, to the households involved they were substantial. For fires which caused someone to miss work, the average total cost was \$398 with an average out-of-pocket cost of \$270.

4. The Costs of Funeral Services

On the basis of the survey sample, a very small proportion (1 percent) of residential fires were estimated to have caused deaths, but this amounted to 7,000 fires causing 8,260 deaths.¹⁷ Table III.2 indicates that 70 percent of these households received aid from some outside source in meeting the funeral costs associated with these fatalities. Insurance companies provided this aid in 10 percent of the cases, while another 40 percent received aid from an unidentified government agency. Others received help from friends and relatives or other sources.

Funeral services are expensive. While Table III.1 indicates that funeral costs averaged only \$16 and \$5 (total and out-of-pocket costs, respectively) per fire, for the fires which involved a fatality the average cost was \$1,606 total, of which \$517 was out-of-pocket expense. It would be interesting to speculate on the sources of the assistance received by these households, but the available data do not fully allow this identification. It seems likely, however, that the participation by insurance companies reflects the use of life insurance settlements to help defray funeral expenses.

5. Extra Costs for Meals

Another of the disruptions which often accompanies residential fires is the inability to prepare meals. This is frequently a problem because residential fires often occur in the kitchen. It is estimated that almost 80,000 households suffered this incon-

venience. When this type of disruption occurs, the household is faced with the need to obtain meals elsewhere, and this may be more costly than cooking at home. The difference between actual meal costs and the cost of meals had the fire not occurred is an indirect cost.

Approximately 11 percent of the residential fires generated indirect costs of this type, averaging \$20 per fire. Not all of these costs were borne by the households involved, however. As shown in Table III.2, approximately one out of four such households received assistance in meeting these costs, most often from insurance companies. It is likely that this represents part of the comprehensive homeowner's policy settlement. When the total extra meal costs were reduced to take into account this outside assistance, the average out-of-pocket cost per fire was approximately \$13.

6. Costs of Demolishing a Damaged Structure

In the most severe of the residential fires, the structure was damaged beyond repair. In such cases, an indirect cost associated with the fire is the cost of demolishing the structure and preparing the site for reconstruction. This was a relatively rare occurrence, with less than 1 percent of the residential fires causing demolition costs.¹⁸ As indicated in Table III.1, total demolition costs averaged only \$8 for each residential fire in an owner-occupied dwelling. Table III.2 indicates that only about one out of ten households experiencing such costs received assistance in meeting them, primarily from

¹⁷ Conceptually, a household could report costs larger than that estimated by multiplying the number of days of work missed by the average daily wage rate if the worker had expected to be working overtime during the period when work was missed.

¹⁸ These figures may reflect an understatement in the data due to difficulty in obtaining interviews from households which had experienced a fire-related fatality. The interview records indicate that nine interview attempts were abandoned because all household members had perished or that interviews were refused because the household felt that the matter was extremely sensitive. Even so, the fatality estimates reported in the text exceed those developed by the NFPA (Derry, 1977), which indicate a total of 8,800 fire deaths in 1976. Assuming that residential fires account for 84 percent of all fire deaths (Clarke and Ottoson, 1976), this would give 7,400 residential fire deaths.

¹⁹ As noted in Chapter II, these figures underestimate demolition costs by not including those incurred by the owners of dwellings in which renters resided. Clearly, these landlord-associated demolition costs should be included in the indirect social costs of residential fires, but it was not possible from the survey data to make any estimates of their frequency or magnitude.

insurance companies. While only 10 percent of the respondents reporting demolition costs indicated that they had been assisted by any outside sources, the average out-of-pocket cost was reduced to less than \$5 per fire. The average demolition costs presented above are small, but to the households involved they are much more substantial. Averaged over only those fires causing demolition costs, the figures for total costs and out-of-pocket costs are \$864 and \$540, respectively.

7. Legal Fees Associated with the Fire and Recovery

Fewer than 1.5 percent of the residential fires resulted in legal fees for the households involved. As indicated in Table III.1, the average total cost per fire was just under \$6. The average out-of-pocket cost was just over \$4, with most of the difference being made up by assistance from insurance companies. Again, these averages taken with respect to all fires understate the impact of the costs of legal fees on the households involved. If legal fees were generated by a residential fire, the average total cost was more than \$445, and the average out-of-pocket cost was over \$309.

The interviews revealed that many of the households reporting legal fees were able to report only the portion not covered by their insurance companies. It appeared that some insurance companies provided legal services to the households without indicating a dollar value for those services. If this is the case, the above estimates of the total cost of legal services may be somewhat understated. Unfortunately, without knowing the frequency or magnitude of these services in kind, it is not possible to impute a value for them.

8. Extra Transportation Costs

Closely related to the internal disruption caused by a residential fire is the need for more frequent travel. Extra travel costs can be generated by the need to visit medical care facilities (either for treatment or to visit in-patients), the need to arrange for repair of the dwelling, or the need to commute longer distances because of the unfavorable location of temporary housing. Less than 4 percent of the residential fires caused this type of cost, and the costs were very small. For total and out-of-pocket costs, respectively, the averages per fire were \$3.75 and \$2.90. Most of the outside assistance in meeting these costs was received from insurance companies.

9. The Costs of Emotional Counseling

Experiencing a fire in one's residence can be an extremely traumatic experience, and the trauma can be long-lasting. Emotional disturbance is clearly an important factor in the indirect effects of residential fires. Unfortunately, however, it is extremely difficult to assign monetary values to these effects.

Conceptually, the cost of emotional disturbance can be viewed as including two components: the cost of the emotional pain, and the monetary cost of professional counseling to alleviate this pain. It was not possible to assign monetary costs to the psychic pain, but it was possible to estimate the costs of the professional counseling. As indicated in Table III.1, these costs averaged just over \$9 per fire, with \$1.70 of this being out-of-pocket cost to the affected household.

While the monetary cost of professional counseling clearly understates the social cost of emotional disturbances, it must also be pointed out that the figures reported here may understate the cost of professional counseling. Some of the households indicated that they had received assistance in this area from government agencies, and this may have taken the form of professional counseling from free community mental health clinics. Unfortunately, there is no way to ascertain when this occurred, or to estimate the value of these services.

10. Costs of Temporary Child Care

Following a residential fire, it is quite possible that adult members of the household will be unable to attend to children for some time. This may result from the adults having been injured, or from the need for them to help in other tasks associated with recovery from the fire. Whatever the reason, when the household finds it necessary to make unusual arrangements for the children, a cost is incurred, and this was considered in the study.

Some respondents reported that their children had been cared for by friends or relatives, and that no costs had been incurred. From the point of view of total social cost, however, costs were involved in such arrangements, and it was necessary to impute a value for the services provided by the friends and relatives. When a household reported receiving such assistance, an attempt was made to estimate a value for the service by comparing the household's reported costs with the average child care costs for all households reporting such costs but not indicating that they had received aid from friends and relatives. The larger of these two values was used as the best measure of the social cost of the household's child care expense.

In fact, however, very few (less than 2 percent) of the residential fires caused child care expenses, and this component makes up only a very small portion of the total indirect costs associated with residential fires. For all fires, the average total cost was slightly more than \$1.30 per fire. When these costs were reduced to take into account the assistance received from outside sources, the average out-of-pocket cost was only \$1.

11. Other Indirect Costs

Just over 4 percent of all residential fires cause indirect fire losses in areas other than the 10 discussed above. These losses averaged \$20 total and \$17 out-of-pocket per residential fire. Approximately one-fourth of the households claiming such losses received assistance from outside agencies.

In an open-ended question, the respondents were asked to describe the nature of these expenses. The most common of these "other" costs was that of moving. Regardless of whether the household moved to another permanent dwelling or to and from temporary housing, the costs incurred would not have occurred without the fire. These expenses clearly reflect an indirect cost resulting from the fire, and the average reported moving expense was slightly more than \$200. The second most frequent, and largest, of the "other" costs was the fee paid to a professional fire adjuster for aiding the household in reaching a settlement with its insurance company. These fees averaged more than \$1,400 for those households which reported them. Additional items listed by the respondents included the expenses incurred for redecorating portions of the dwelling not actually damaged by the fire, the cost of dry-cleaning clothes to eliminate odors and stains, utility payments paid while the household was unable to live in the dwelling, veterinarian fees, and fees for telephone installation. Most of these are relatively minor and infrequent, but their occurrence serves to provide additional insight into the kinds of problems faced by households as they attempt to recover from serious residential fires. As stated previously, these "other" costs averaged slightly over \$20 per fire total, and \$17 per fire out-of-pocket (Table III.1). The relatively small amount of assistance the households received in defraying these costs came from insurance companies (Table III.2).

12. Nonmonetary Costs

In addition to the monetary costs described in the previous pages, the households surveyed suffered a variety of nonmonetary costs. Respondents who reported monetary costs were asked about three different types of nonmonetary costs: changes in their household composition, emotional disturbance, and the loss of irreplaceable objects.

Slightly under 2.5 percent of all residential fires cause the household involved to experience a major compositional change. The most common of these changes was the situation in which some member of the household moved away. This could occur for a variety of reasons: members of the family being institutionalized for injuries or emotional reasons; children being placed with friends, relatives, or foster homes; parents becoming divorced; or parents simply separating. While these are extremely rare occurrences, the data suggest that as many as 4,000 households may have had members separated from their spouses and as many as 8,000 households may have had someone move out as a result of a residential fire.

The monetary costs associated with emotional disturbance were discussed before. In addition to being queried about these monetary costs, respondents were asked whether any member of their households had experienced such emotional disturbances as loss of appetite, recurrent nightmares, inability to sleep at night, or other manifestations of emotional unrest. Approximately 12 percent of the residential fires resulted in at least one household member experiencing such difficulties, and 115,000 persons were involved. Of these, 29 percent had problems considered very serious, while an additional 39 percent had problems considered somewhat serious. Only 15 percent of these persons suffering emotional problems because of the fires received professional counseling.

Finally, families experiencing residential fires often find that the fire destroys items to which a monetary value cannot be attached, such as family heirlooms, treasured photographs or paintings,

important documents, or similar items. On the basis of the survey data it is estimated that at least 14 percent of all residential fires generated some loss of this type, affecting almost 100,000 households. Table III.8 shows estimated frequencies of the occurrence of these types of loss. Clearly, the most frequent was the loss of photographs or paintings, followed by the loss of family heirlooms and documents. The loss of pets may be particularly tragic to households with small children, and may have been experienced by as many as 39,000 households.

13. Summary

It is apparent from this discussion that the indirect costs associated with residential fires are far from trivial. In monetary terms, the average residential fire caused a total indirect cost of over \$440, of which more than half came directly out of the pockets of the households affected. It is also apparent that these figures tend to understate the magnitude of the monetary costs to the households involved. Only a relatively small portion of residential fires caused any indirect costs, but for those that did the average was over \$1,500. Similarly, out-of-pocket indirect costs averaged more than \$720 to the households involved.

In addition, residential fires caused a wide variety of nonmonetary costs such as pain, emotional disturbance, household disruption, and loss of irreplaceable items. While it is not possible to specify a value for these kinds of costs, their frequency and nature suggest that they are extremely important part of the total burden placed on society by the occurrence of residential fires.

B. Relationships Between Indirect Costs Caused by Residential Fires and Characteristics of the Households Experiencing the Fires

The previous pages have discussed various characteristics of the indirect costs caused by residential fires independent of any characteristics of the households which experienced the fires. On the basis of questions asked, it was also possible to draw some general conclusions about the types of households which tend to experience indirect costs from residential fires.

Table III.9 indicates the percent distribution of indirect fire costs according to the type of residential structure, the latter characteristic being broken down into single-family and multiple-dwelling structures.

More than 47 percent of single-family structure fires causing indirect costs generated costs in excess of \$1,000, while only 35 percent of multiple-dwelling structure fires did so. This observation probably

TABLE III.8

Percent Distribution of Irreplaceable Items Destroyed by Fires

Items Lost	Percent of Residential Fires Causing Such a Loss ¹
Photographs or Paintings	14.2
Family Heirlooms	9.5
Important Documents	8.7
Antiques or Rare Furniture	6.6
Pets	5.6
Other	4.7

¹ These are not mutually exclusive events, and cannot be added to obtain the total frequency of the loss of such items.

TABLE III.9

Percent Distribution of Indirect Fire Costs by Single-Family Structure and Other Structure

Total Cost And Out-Of-Pocket Cost ¹

Type of Residential Structure	Percent of Fires ² Causing Indirect Costs of: (\$)								
	\$1 to \$100	\$101 to \$200	\$201 to \$500	\$501 to \$750	\$751 to \$1,000	\$1,001 to \$1,500	\$1,501 to \$6,500	\$6,501 and over	Total
Single-Family Structure ³	10.6% (26.6%)	10.5% (13.8%)	16.9% (23.7%)	7.1% (10.8%)	7.5% (7.4%)	10.5% (4.9%)	33.1% (9.9%)	3.8% (2.9%)	100.0% (100.0%)
Other	28.7 (25.9)	7.0 (16.7)	16.5 (20.4)	8.3 (6.4)	4.4 (3.7)	8.3 (9.3)	21.7 (15.7)	5.1 (1.9)	100.0 (100.0)
Totals	17.2 (26.4)	9.2 (14.8)	16.8 (22.5)	7.6 (9.3)	6.4 (6.1)	9.7 (6.4)	28.8 (11.9)	4.3 (2.6)	100.0 (100.0)

¹ Out-of-Pocket Costs are in parentheses.

² Percent of fires causing nonzero indirect costs.

³ Includes mobile homes.

reflects the tendency of households living in single-family structures to be larger, and thus potentially more vulnerable to the costs of disruption. It may also reflect the tendency of owner-occupants to have higher incomes, and therefore to experience higher indirect costs due to missed work. At the same time, over 5 percent of the indirect costs from fires in other types of structures were in excess of \$6,500, compared to only 3.8 percent for single-family structure fires, a fact reflecting the occurrence of fires in multiple-dwelling structures which affect several households and thus cause very large in-

direct costs.

This general pattern reverses itself when out-of-pocket costs are considered. Only 18 percent of the single-family fire costs were in excess of \$1,000, while the comparable figure for other structures was 27 percent. This apparently reflects greater assistance from insurance, since single-family occupants are more likely to have comprehensive homeowners' coverage than are multiple-dwelling occupants. Higher income, salaried employees are also more likely to be able to miss work without a reduction in pay.

¹⁰ It must be noted that the internal structure of the interview instrument was such that not all respondents were asked for household characteristics. Those not asked were those reporting no indirect costs associated with dislocation and injury. This group can be assumed to have had relatively low indirect costs associated with their fires.

¹¹ Only households reporting indirect costs associated with injury or dislocation were asked for ethnic background.

¹² The sampling procedure included the selection of two of the ten cluster sites as predominantly rural counties in the States of Oregon and Ohio. Due to the mechanics of the sampling process, it was not possible to ensure that these two clusters were completely rural.

TABLE III.10
Percent Distribution of Indirect Fire Costs by Household Income Categories

Household Income (\$) ³	Total Cost And Out-Of-Pocket Cost ¹ Percent of Fires ² Causing Indirect Costs of: (\$)								Total
	\$1 to \$100	\$101 to \$200	\$201 to \$500	\$501 to \$750	\$751 to \$1,000	\$1,001 to \$1,500	\$1,501 to \$6,500	\$6,501 and over	
0 to 9,999	21.2% (27.6%)	7.8% (16.5%)	18.4% (26.0%)	6.7% (7.9%)	7.3% (4.7%)	8.4% (5.5%)	26.3% (10.2%)	3.9% (1.6%)	100.0% (100.0%)
10,000 to 14,999	20.8 (23.7)	11.9 (12.5)	13.9 (23.6)	7.9 (8.3)	6.9 (8.3)	8.9 (8.3)	26.7 (13.9)	3.0 (1.4)	100.0 (100.0)
15,000 to 24,999	9.4 (25.8)	10.6 (15.2)	21.2 (19.7)	10.6 (15.2)	4.7 (4.5)	9.4 (3.0)	29.4 (12.1)	4.7 (4.5)	100.0 (100.0)
25,000 and over	10.5 (23.3)	10.5 (16.7)	15.8 (16.7)	0.0 (6.7)	7.9 (3.3)	13.2 (10.0)	31.6 (16.7)	10.5 (6.6)	100.0 (100.0)
Totals	17.2 (26.4)	9.2 (14.8)	16.8 (22.5)	7.6 (9.3)	6.4 (6.1)	9.7 (6.4)	28.8 (11.9)	4.3 (2.6)	100.0 (100.0)

¹ Out-of-Pocket Costs are in parentheses.

² Percent of fires causing nonzero indirect costs.

³ Only respondents reporting either dislocation or injury were asked to indicate their household income.

Table III.10 presents similar frequency distributions among several broad categories of household income.¹⁹ The patterns apparent from this table are consistent with those suggested in the discussion of housing structure type. Fires affecting households in higher income categories are more likely to cause indirect costs of more than \$1,000 than are fires experienced by lower income households. This pattern holds for total cost and out-of-pocket costs, and presumably reflects the kinds of vulnerability discussed previously.

When the ethnic backgrounds of the households are examined (see Table III.11),²⁰ the patterns which emerge are consistent with the pervasive relationships between income and race, and the findings from Table III.10. Of the fires which caused indirect costs to white households, more than 48 percent caused losses in excess of \$1,000. The comparable figure for nonwhite households was only 36 percent. Again, this pattern holds for out-of-pocket costs as well as for total indirect costs.

Finally, in order to determine whether indirect fire losses tended to differ with dwelling location,

cross-tabulations were prepared showing the percent distributions of losses according to whether the fire occurred in an urban or rural location.²¹

It appears from Table III.12 that the indirect cost caused by a residential fire is not independent of its location. A much higher proportion of urban fires caused more than \$1,000 in indirect costs (45 percent) than was the case for fires in predominantly rural areas (34 percent). This may reflect the income phenomenon discussed above, but may also mean that rural dwellers may be self-employed (farmers) and unable to estimate the costs of missed work. At any rate, the difference between urban and rural fires holds for both total indirect costs and out-of-pocket costs.

While the relationships described here are not strong, they do suggest that the monetary value of indirect costs from a residential fire are related to the income of the occupants of the dwelling. This may reflect a greater value placed on time missed from work, or the tendency to spend more for temporary shelter and meals during the time that the burned dwelling is being repaired. It may also reflect

TABLE III.11
Percent Distribution of Indirect Fire Costs by Household Ethnic Background
Total Cost And Out-Of-Pocket Cost ¹

Household Ethnic Background ³	Percent of Fires ² Causing Indirect Costs of: (\$)								Total
	\$1 to \$100	\$101 to \$200	\$201 to \$500	\$501 to \$750	\$751 to \$1,000	\$1,001 to \$1,500	\$1,501 to \$6,500	\$6,501 and over	
White ⁴	15.1% (21.8%)	9.0% (15.6%)	13.5% (21.8%)	7.4% (8.9%)	6.9% (6.7%)	11.0% (6.7%)	30.6% (15.1%)	6.5% (3.4%)	100.0% (100.0%)
Nonwhite	20.1 (32.3)	9.8 (13.8)	21.3 (23.1)	8.0 (10.0)	5.2 (5.4)	7.5 (5.4)	27.0 (8.5)	1.1 (1.5)	100.0 (100.0)
Totals	17.2 (26.4)	9.2 (14.8)	16.8 (22.5)	7.6 (9.3)	6.4 (6.1)	9.7 (6.4)	28.8 (11.9)	4.3 (2.6)	100.0 (100.0)

¹ Out-of-Pocket Costs are in parentheses.

² Percent of fires causing nonzero indirect costs.

³ Only respondents reporting dislocation or injury were asked to indicate their household ethnic backgrounds.

⁴ Includes Spanish or Latin.

TABLE III.12
Percent Distribution of Indirect Fire Costs by Structure Location

Total Cost And Out-Of-Pocket Cost ¹

Location	Percent of Fires ² Causing Indirect Costs of: (\$)								Total
	\$1 to \$100	\$101 to \$200	\$201 to \$500	\$501 to \$750	\$751 to \$1,000	\$1,001 to \$1,500	\$1,501 to \$6,500	\$6,501 and over	
Urban	17.2% (24.8%)	8.6% (15.3%)	15.4% (23.3%)	7.4% (8.8%)	6.3% (6.1%)	8.8% (6.1%)	31.7% (13.3%)	4.6% (2.3%)	100.0% (100.0%)
Predominantly Rural	17.1 (33.3)	11.8 (11.8)	22.4 (17.7)	7.9 (13.7)	6.6 (5.9)	14.5 (7.8)	17.1 (5.9)	2.6 (3.9)	100.0 (100.0)
Totals	17.2 (26.4)	9.2 (14.8)	16.8 (22.5)	7.6 (9.3)	6.4 (6.1)	9.7 (6.4)	28.8 (11.9)	4.3 (2.6)	100.0 (100.0)

¹ Out-of-Pocket Costs are in parentheses.

² Percent of fires causing nonzero indirect costs.

the ability and tendency to seek care for injuries and emotional disturbances occurring as a result of the fire. The relationship between indirect costs and income seems to emerge in relationships between indirect losses and the other household characteristics in exactly the way one would expect, given the relationships between income and race, and income and housing type.

C. Relationships Between Indirect Costs Caused by Residential Fires and the Direct Losses Caused by Those Fires

Since most indirect costs are caused by fires which also cause direct property losses, it seemed useful to examine relationships between the two, since if a strong relationship existed, estimation of indirect costs would be facilitated. Table III.13 presents a percent distribution of fires causing nonzero indirect costs for three direct-loss classifications which correspond to the definitions of the strata used in the sampling design. Table III.14 presents a distribution of indirect costs against reported property losses.²² Several things are apparent from these tables. From Table III.13 it is clear that fires

²² Total property losses (or total occupancy losses) are as reported by the fire departments on their incident report forms. As discussed in Chapter IV, this is the most useful estimate of property loss because it is the only one available to local officials without conducting a survey.

TABLE III.13
Percent Distribution of Indirect Fire Costs by Direct Loss Category
Total Cost And Out-Of-Pocket Cost ¹

Direct Loss Category	Percent of Fires ² Causing Indirect Costs of: (\$)								Total
	\$1 to \$100	\$101 to \$200	\$201 to \$500	\$501 to \$750	\$751 to \$1,000	\$1,001 to \$1,500	\$1,501 to \$6,500	\$6,501 and over	
Death or Injury	13.3% (32.2%)	9.7% (11.9%)	21.7% (18.6%)	8.4% (13.5%)	1.2% (0.0%)	7.2% (6.8%)	30.1% (11.9%)	8.4% (5.1%)	100.0% (100.0%)
No Death or Injury, Property Loss Greater Than \$1,000	12.6 (20.0)	8.3 (13.7)	16.6 (25.9)	6.1 (8.8)	8.7 (8.3)	10.8 (6.8)	32.9 (14.1)	4.0 (2.4)	100.0 (100.0)
No Death or Injury, Property Loss Less Than or Equal to \$1,000	41.5 (44.9)	12.3 (22.4)	10.8 (12.2)	12.3 (8.2)	3.1 (4.1)	7.7 (4.1)	12.3 (4.1)	0.0 (0.0)	100.0 (100.0)
Totals	17.2 (26.4)	9.2 (14.8)	16.8 (22.5)	7.6 (9.3)	6.4 (6.1)	9.7 (6.4)	28.8 (11.9)	4.3 (2.6)	100.0 (100.0)

¹ Out-of-Pocket Costs are in parentheses.

² Percent of fires causing nonzero indirect costs.

either causing injury or death, or causing property loss in excess of \$1,000, are much more likely to cause indirect costs in excess of \$1,000 than are fires causing only minor property damage. In addition, a much higher proportion of the injury/death fires causes indirect costs in the highest cost category, a finding which reflects the very high medical costs associated with severe fire injuries.

Table III.14 tends to reinforce the general relationship between direct losses and indirect costs suggested in Table III.13. Fires which cause large

indirect costs tend to be those which also cause large direct losses, while fires causing small amounts of indirect costs tend to be those which cause small amounts of direct loss. The relationship between the two is not perfect, however, as a considerable number of the fires which caused large amounts of direct property losses generated relatively small indirect costs.²³ These relationships will be explored further in Chapter IV, where techniques for preparing local estimates of indirect costs are discussed.

For those who are technically oriented:

²³ The lack of a strong systematic relationship between indirect costs and direct property losses is clearly demonstrated by performing a simple regression analysis, using total indirect costs (TIC) as the dependent variable and reported property losses (PL) as the independent variable. The following equation was generated: $TIC = 34.66 + 0.1875 PL$. The coefficient of the independent variable is significant at the .01 level, but the coefficient determination (R^2) was only 0.079.

TABLE III.14
Percent Distribution of Indirect Fire Costs by Direct Property Loss
Total Cost And Out-Of-Pocket Cost ¹

Direct Property Loss (\$)	Percent of Fires ² Causing Indirect Costs of: (\$)									
	0	\$1 to \$100	\$101 to \$200	\$201 to \$500	\$501 to \$750	\$751 to \$1,000	\$1,001 to \$1,500	\$1,501 to \$6,500	\$6,501 and over	Total
0	97.0% (97.0%)	1.0% (1.0%)	0.0% (1.0%)	1.0% (0.0%)	1.0% (1.0%)	0.0% (0.0%)	0.0% (0.0%)	0.0% (0.0%)	0.0% (0.0%)	100.0% (100.0%)
1 to 100	84.1 (87.7)	6.6 (6.6)	1.9 (0.0)	2.8 (3.8)	0.9 (1.9)	0.9 (0.0)	1.9 (0.0)	0.9 (0.0)	0.0 (0.0)	100.0 (100.0)
101 to 500	71.7 (78.7)	9.4 (11.8)	6.3 (3.1)	4.8 (2.4)	3.1 (1.6)	0.0 (0.0)	1.6 (1.6)	3.1 (0.8)	0.0 (0.0)	100.0 (100.0)
501 to 1,000	60.3 (73.5)	11.8 (10.3)	4.4 (8.8)	5.9 (3.0)	4.4 (2.9)	2.9 (1.5)	1.5 (0.0)	5.9 (0.0)	2.9 (0.0)	100.0 (100.0)
1,001 to 2,500	51.4 (69.7)	13.4 (11.3)	5.6 (3.5)	9.2 (9.2)	2.1 (0.7)	3.5 (2.8)	5.6 (1.4)	8.5 (0.7)	0.7 (0.7)	100.0 (100.0)
2,501 to 5,000	31.2 (49.6)	8.8 (13.6)	7.2 (11.2)	13.6 (12.8)	6.4 (3.2)	4.8 (0.8)	4.8 (3.2)	20.0 (4.8)	3.2 (0.8)	100.0 (100.0)
5,001 to 7,500	18.7 (37.5)	10.4 (12.5)	6.2 (6.2)	8.3 (16.7)	14.6 (8.3)	4.2 (2.1)	12.5 (6.3)	22.9 (8.3)	2.1 (2.1)	100.0 (100.0)
7,501 to 10,000	15.9 (31.8)	9.1 (6.8)	6.8 (13.6)	15.9 (18.2)	0.0 (4.6)	6.8 (6.8)	13.6 (6.8)	29.6 (11.4)	2.3 (0.0)	100.0 (100.0)
10,001 and over	11.3 (31.5)	4.8 (8.1)	2.4 (5.6)	12.9 (12.9)	4.0 (9.7)	6.5 (6.5)	7.3 (4.8)	43.5 (16.9)	7.3 (4.0)	100.0 (100.0)
Totals	51.9 (64.6)	8.3 (9.3)	4.4 (5.2)	8.1 (8.0)	3.6 (3.4)	3.1 (2.0)	4.5 (2.3)	14.1 (4.3)	2.0 (0.9)	100.0 (100.0)

¹ Out-of-Pocket Costs are in parentheses.

² Includes all fires including those with no indirect costs.

IV. TECHNIQUES FOR LOCAL ESTIMATION OF INDIRECT RESIDENTIAL FIRE COSTS



IV. TECHNIQUES FOR LOCAL ESTIMATION OF RESIDENTIAL INDIRECT FIRE COSTS

The previous chapters have discussed national estimates of total indirect costs of residential fires and the various components of indirect costs based on data from a survey of 883 households across the country. This chapter discusses methods by which fire officials can estimate the magnitude of the indirect costs from residential fires in their own service areas.

There are several approaches to this problem. The simplest makes use of the average value of total indirect costs per fire. Using estimates from this study, and the number of reported residential fires occurring in the local area during the specified period, an estimate of local indirect costs incurred during that period can be obtained. A slightly more complex version of this approach is to consider averages for different categories of residential fires, as was done in making the national estimates, and then estimating indirect costs for each category. When added, these estimates represent the total amount of indirect costs occurring in the area.

A third approach makes use of the observed relationship between the indirect costs caused by a residential fire and the direct property losses which that fire caused. Residential fires can be grouped into categories of direct property loss and indirect costs estimated for each category. Again, the indirect costs for the categories are totaled to obtain an estimate of indirect costs from the reported residential fires.

Each of these approaches is discussed here, with the appropriate findings from the analysis of the sample data from this study.

1. Use of a Simple Average

The most direct approach to estimating the total indirect costs incurred annually in a local area due to reported residential fires is to multiply the number of residential fires reported in the area in a given year by the average total indirect cost caused by each residential fire. Based on the data presented in Chapter II, the average value for the total indirect costs caused by all reported residential fires is approximately \$440. On this basis, the total indirect

cost (TIC) incurred annually by a local area due to residential fires can be estimated as:

$$TIC = \$440 \times N$$

(N = the number of residential fires reported annually).

It must be pointed out that the average value of \$440 represents the mean of a distribution of indirect costs, and that in local areas experiencing small numbers of fires the expected variation around this mean can be substantial.

2. Simple Averages for Classes of Residential Fires

As was done in designing the current research, local fire officials can attempt to reduce the variation caused by the use of a simple average value of indirect costs by breaking the residential fires into classes and using different averages for each class. We defined three general classifications in this research: Class I, where the fire caused an injury or a death; Class II, where no injury or death was reported, but property loss was estimated as being in excess of \$1,000; and Class III, where no injury or death was reported, and property loss was estimated as being less than or equal to \$1,000. The data indicated that the average indirect cost caused per fire varied substantially between these three classes. The estimated average indirect cost for all fires in each class are presented in Table IV.1.

Using these estimates, local officials can estimate the indirect costs incurred from reported residential fires experienced annually in their service areas as follows:

$$TIC = \$3,275 \times N_I + \$1,185 \times N_{II} + \$80 \times N_{III}$$

N_I = the number of residential fires causing injury or death,

N_{II} = the number of fires not causing injury or death, but causing property loss of more than \$1,000,

N_{III} = the number of fires not causing injury or death, but causing

property loss less than or equal to \$1,000, and

$N_I + N_{II} + N_{III}$ = all residential fires reported in the area.

This approach is slightly more complex than the first, but it reduces the error introduced by using a single average value for indirect costs per fire.

TABLE IV.1

Average Total Indirect Cost Per Fire by Class of Fire

Class	Estimated Average Total Indirect Costs Per Fire
1. Fires Causing Injury or Death	\$3,275
2. Fires Causing No Injury or Death, but Property Loss Greater Than \$1,000	1,185
3. Fires Causing No Injury or Death, but Property Loss Less Than or Equal to \$1,000	80

3. Simple Averages for Direct Property Loss Categories

As indicated in the previous chapter, residential fires which cause large indirect costs tend to be those which also cause large amounts of direct property losses. Thus it seems reasonable to expect that the average indirect cost will be different for fires causing different amounts of direct property loss, and the use of property loss categories may reduce the overall error introduced into the estimates. Examination of the data from the survey of households experiencing residential fires indicated that the following categories of reported direct property losses²⁴ seemed to be responsible for classifying the data for this purpose: \$0 to \$500; \$501 to \$5,000; \$5,001 to \$10,000; and \$10,001 and over. Average estimated losses per category are shown in Table IV.2.

Thus, the local estimate of total indirect costs from residential fires becomes:

$$\text{TIC} = \$118 \times N_1 + \$812 \times N_2 \\ + \$1,312 \times N_3 + \$3,353 \times N_4$$

N_1 = number of residential fires causing property loss up to \$500,

N_2 = number of residential fires causing property loss from \$501 to \$5,000,

N_3 = number of residential fires causing property loss from \$5,001 to \$10,000,

N_4 = number of residential fires causing property loss greater than \$10,000, and

$N_1 + N_2 + N_3 + N_4$ = all residential fires reported in the area.

It should be noted that the figures included in the three estimating procedures provide indirect cost estimates expressed in terms of early 1977 dollars. When local estimates are made for future years, it will be necessary to adjust the resultant figures to recognize changes in prices. Since most of the costs considered in the indirect cost estimates are also included in the computation of the Consumer Price Index, it is reasonable to use this Index as a basis of the adjustment process. Specifically, the estimated total indirect costs (TIC) should be multiplied by the ratio of the Consumer Price Index (CPI) for the year for which estimates are being made (y), to the CPI for 1977.

$$\text{TIC}_y = \text{TIC} \times \frac{\text{CPI}_y}{\text{CPI}_{1977}}$$

TABLE IV.2

Average Total Indirect Costs for Various Direct Property Loss Categories

Property Loss Category (in \$)	Average Total Indirect Costs (in \$)
0 to 500	118
501 to 5,000	812
5,001 to 10,000	1,312
10,001 and over	3,353

4. Summary

It is difficult to assess the accuracy of the various methods for making local estimates of total indirect costs arising from reported residential fires. It is likely, however, that the relatively more complicated procedures outlined in Sections 2 and 3 are to be preferred in that they incorporate nonlinearities into the relationship between indirect and direct costs. An important operational criterion is the data which are available, and the amount of data sorting which the local agency wishes to do. The least demanding in this regard is method one, which requires simply the number of reported residential fires which occurred in the specified time period. Most demanding is method three, which requires that the number of residential fires be broken down into four property loss categories.

²⁴ Reported direct property loss is used here because it is the only information available to local officials.



